

South Rush Lake

Site Description

Location

| | |
|--------------------------------|--|
| Water designation number (WDN) | 22-0064-00 |
| Legal description | T122N-R54W-Sec. 5,6,31,32,33; T122N-R55W-Sec. 36 |
| County (ies) | Day |
| Location from nearest town | 1.0 mile west of Waubay, SD |

Survey Dates and Sampling Information

| | |
|--------------------|------------------------|
| Survey dates | June 4-6, 2013 (FN,GN) |
| Frame net sets (n) | 17 |
| Gill net sets (n) | 6 |

Morphometry

| | |
|------------------------|---------|
| Watershed area (acres) | 186,967 |
| Surface area (acres) | ≈1,700 |
| Maximum depth (ft) | ≈10 |
| Mean depth (ft) | unknown |

Ownership and Public Access

South Rush Lake is a meandered lake owned by the State of South Dakota and the fishery is managed by SDGFP. A boat ramp located on the Herold-Stanley WAA provides public boat access to the lake (Figure 1). Shorefishing opportunities exist at the Blue Dog Spillway, from state-owned lands (Herold-Stanley WAA), and along Highway 12 (parking is limited) which divides North and South Rush Lakes. Lands adjacent to the lake have mixed ownership including the State of South Dakota and private individuals.

Watershed and Land Use

The 11,969 acre Rush Lake sub-watershed is located within the larger (186,967 acres) Waubay Lakes watershed. Land use within the Waubay Lakes watershed is primarily agricultural with a mix of pasture or grassland, cropland, and woodland.

Water Level Observations

No Ordinary High Water Mark has been established by the South Dakota Water Management Board on the Rush Lakes. On May 21, 2013 the elevation of the Rush Lakes was 1803.3 fmsl, approximately 0.9 ft higher than the fall 2012 elevation of 1802.4 fmsl. By October 8, 2013 the water level had declined to an elevation of 1802.7 fmsl.

Fish Management Information

| | |
|-----------------------------|---|
| Primary species | Northern Pike, Walleye, Yellow Perch |
| Other species | Black Bullhead, Black Crappie, Common Carp, Orangespotted Sunfish, Spottail Shiner, Rock Bass, White Bass, White Sucker |
| Lake-specific regulations | Game Fish Spearing Allowed (June 15-March 15) |
| Management classification | warm-water marginal |
| Fish Consumption Advisories | none |

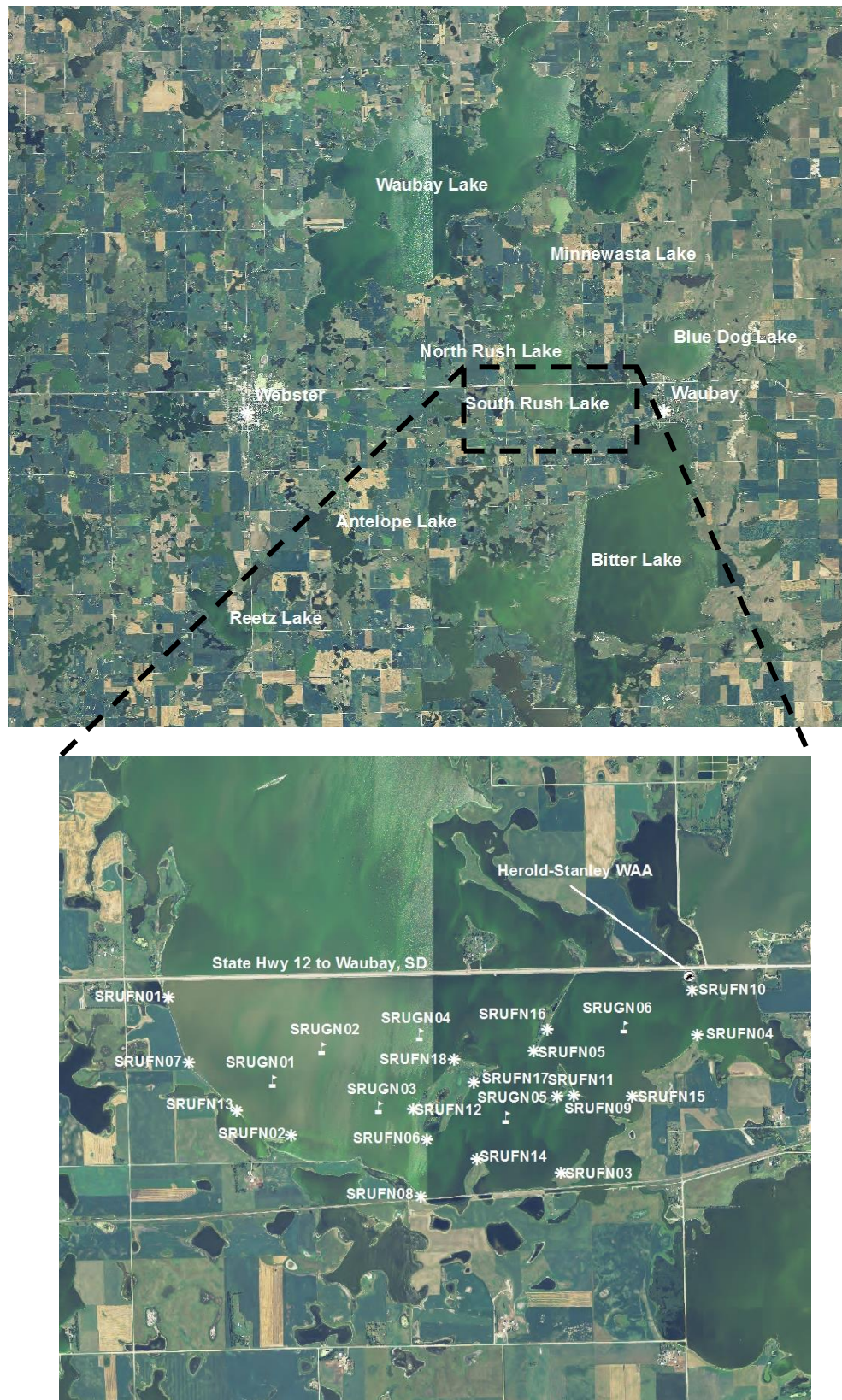


Figure 1. Map depicting geographic location of several Day County, South Dakota Lakes including South Rush Lake (top). Also noted is the public access site (Herold-Stanley WAA) and standardized net locations for South Rush Lake. SRUFN= frame nets; SRUGN= gill nets

Management Objectives

- 1) Maintain a mean gill net CPUE of stock-length Northern Pike ≥ 3 , a PSD of 30-60, and a PSD-P of 5-10.
- 2) Maintain a mean gill net CPUE of stock-length Walleye ≥ 10 , a PSD of 30-60, and a PSD-P of 5-10.
- 3) Maintain a mean gill net CPUE of stock-length Yellow Perch ≥ 30 , a PSD of 30-60, and a PSD-P of 5-10.

Results and Discussion

Prior to the 1990s, South Rush Lake was shallow, experienced frequent winterkill events, and offered limited sport fishing opportunities. High water conditions since the mid to late 1990s have increased the water depth and surface area of South Rush Lake, diminished the threat of winterkill and created habitat capable of sustaining a sport fishery. Currently, South Rush Lake is managed as a Northern Pike, Walleye and Yellow Perch fishery.

Primary Species

Northern Pike: The mean gill net CPUE of stock-length Northern Pike was 6.5 (Table 1) and above the minimum objective of (≥ 3 stock-length Northern Pike/net night; Table 3). The 2013 gill net CPUE represented an increase from the 2010 CPUE of 1.2 (Table 2). Currently relative abundance is high, which can be attributed to increased recruitment likely related to substantial rises in spring water levels that took place from 2008-2011 (SDDENR 2014). Northern Pike depend heavily on flooded vegetation for spawning and recruitment, and tend to have improved recruitment during springs that have rising water levels.

Gill net captured Northern Pike ranged in TL from 33 to 72 cm (13.0 to 28.3 in), with the majority being \geq quality-length (53 cm; 21 in; Figure 2). The PSD was 97 and above the management objective of 30-60; while the PSD-P was 5 and within the management objective of 5-10 (Table 1; Table 3). Size structure indices should be interpreted with caution as sample size was low (i.e., 40 stock-length Northern Pike).

No age or growth information was collected. Condition of gill net captured Northern Pike was similar to that of Northern Pike captured from other northeast South Dakota lakes (e.g., Bitter and Antelope Lakes). The mean W_r of quality-preferred length fish, which comprised nearly the entire (92%) sample, was 83. Relative weight values were likely at a seasonal low. Neumann and Willis (1995) reported that W_r values were lowest during spring following the spawn and throughout the summer in Lake Thompson, South Dakota.

Walleye: The mean gill net CPUE of stock-length Walleye was 14.7 (Table 1) and above the minimum objective (≥ 10 stock-length Walleye/net night; Table 3). The 2013 gill net CPUE represented a substantial increase from the 2010 CPUE of 4.2 (Table 2) and indicated high relative abundance.

Walleye captured in the 2013 gill net catch ranged in TL from 12 to 63 cm (4.7 to 24.8 in), had a PSD of 86 and a PSD-P of 15 (Table 1; Figure 3). Both the PSD and PSD-P were above management objective ranges of 30-60 and 5-10; respectively, indicating a population comprised of larger (i.e., ≥ 38 cm; 15 in) individuals (Table 3; Figure 3).

Otoliths were collected from a sub-sample of gill net captured Walleye. Age structure information suggested the presence of eight year classes (2002, 2005, and 2007-2012; Table 4). The 2010 year class, which coincided with a fry stocking, was the most represented and comprised 60% of Walleye in the gill net catch (Table 4; Table 6). The 2010 fry stocking was marked with Oxytetracycline (OTC) so that the contribution of stocked fish could be evaluated; unfortunately, only 11 age-0 Walleye were captured in the fall of 2010 and no marks were detected (Table 4). The reliability of the estimated stocking contribution (0%) is questionable due to the low sample size inspected for OTC marks and the apparent strength of the 2010 year class. Cohorts produced in 2008 and 2009 comprised an additional 13% and 15% and appear to be the result of natural reproduction (Table 4). However, it is difficult to determine the source of walleye cohorts in South Rush Lake because the lake has direct connections to several lakes (e.g., Blue Dog, North Rush and Bitter Lakes); all of which, have existing walleye populations that are supplemented by stocking.

Walleye in South Rush Lake currently exhibit fast growth with weighted mean TL at capture values of 420 and 492 mm (16.5 and 19.4 in) at ages 3 and 4, respectively (Table 5). In 2013, gill net captured Walleye exhibited a slight decreasing trend in condition as TL increased. However, condition was acceptable for all length categories (e.g., stock to quality) sampled, with mean Wr values that ranged from 86 to 91. The mean Wr of stock-length Walleye was 89 (Table 1).

Yellow Perch: The mean gill net CPUE of stock-length Yellow Perch was 12.3 (Table 1) and below the minimum objective (≥ 30 stock-length Yellow Perch/net; Table 3). The 2013 mean gill net CPUE was similar to the 2010 CPUE of 12.2 (Table 2) and indicated moderate relative abundance.

Yellow perch sampled in gill nets ranged in TL from 10 to 36 cm (3.9 to 14.2 in; Figure 4). The PSD of 32 was within the management objective of 30-60; while the PSD-P of 23 was above the management objective of 5-10 (Table 3) and indicated a relatively-high proportion of individuals \geq preferred-length (25 cm; 10 in) in the sample (Figure 4).

Otoliths were collected from a sub-sample of gill net captured Yellow Perch. Age structure information suggested the presence of five year classes (2007, 2009-2012; Table 7). The 2011 cohort was the most abundant and comprised 72% of yellow perch in the gill net catch (Table 7).

The weighted mean TL at capture for age-2 male Yellow Perch was 175 mm (6.9 in); while the weighted mean TL at capture for age-2 female Yellow Perch was 178 mm (7.0 in; Table 8). Gill net captured Yellow Perch had mean Wr values that ranged from 92 to 115 for all length categories (e.g., stock to quality) sampled. The mean Wr of stock-length Yellow Perch was 98 (Table 1) and no length-related trends in condition were apparent.

Other Species

Black Bullhead: Black Bullheads were the most abundant fish species in the frame net catch with a mean frame net CPUE for stock-length Black Bullhead of 9.2 (Table 1). The 2013 mean frame net CPUE represented an increase from the 2010 CPUE of 1.0 (Table 2).

Black Bullheads in the frame net catch ranged in TL from 12 to 37 cm (4.7 to 14.6 in), had a PSD of 78 and PSD-P of 46 (Table 1). Visual inspection of the length-frequency suggested consistent recruitment of varying magnitude, as nearly all cm-length groups from 12 to 37 cm were represented. No age and growth information was collected. The mean Wr of stock-length Black Bullhead was 96 (Table 1) and no length-related trends in condition were apparent.

Black Crappie: The mean frame net CPUE of stock-length Black Crappie was 4.3 (Table 1). The 2013 frame net CPUE represented an increase from the 2010 CPUE of 1.6 (Table 2) and indicated moderate relative abundance.

Frame net captured Black Crappie ranged in TL from 17 to 35 cm (6.7 to 13.8 in) had a PSD of 96 and a PSD-P of 40 (Table 1; Figure 5). Length-frequency analysis suggested inconsistent recruitment, with what appeared to be a single strong cohort that ranged in TL from 22 to 29 cm (8.7 to 11.4 in) dominating the sample (Figure 5).

No age or growth information was collected. A decreasing trend in Black Crappie condition was apparent as TL increased; however, mean Wr values were ≥ 104 for all length categories (e.g., stock to quality) sampled. Seasonal influences (i.e., spawning behavior) may have influenced Wr values.

White bass: White bass were not well represented in the gill net catch, but were one of the more abundant species in the frame net catch (Table 1). The mean frame net CPUE of stock-length White Bass was 5.9 (Table 1).

Frame net captured White Bass ranged in TL from 31 to 45 cm (12.2 to 17.7 in), had a PSD of 100 and a PSD-P of 100 (Table 1). Limited recruitment and relatively fast growth to quality- and preferred-lengths contribute to the high size structure. No age and growth information was collected. White Bass in the frame net catch had mean Wr values that ranged from 95 to 99 for all length categories (e.g., stock to quality) sampled. The mean Wr of stock-length White Bass was 98 (Table 1).

Other: Common Carp, Orangespotted Sunfish, Rock Bass, Spottail Shiner, and White Sucker were other fish species captured in low numbers during the 2013 survey (Table 1).

Management Recommendations

- 1) Conduct fish community surveys utilizing gill nets and frame nets on an every third year basis (next survey scheduled in summer 2016) to monitor fish relative abundance, fish population size structures, fish growth, and stocking success.
- 2) Stock walleye (≈ 500 fry/acre) on a biennial basis to establish additional year classes, provided water levels are sufficient.
- 3) Collect otoliths from walleye and yellow perch to assess age structure and growth rates of each population.
- 4) Monitor winter and summer kill events. In cases of substantial winter/summer kill the need to re-establish a fishery in South Rush Lake should be evaluated. If water levels are sufficient; Northern Pike, Walleye and Yellow Perch should be stocked to re-establish a fish community.

Table 1. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length fish (PSD-P), and mean relative weight (Wr) of stock-length fish for various fish species captured in frame nets and experimental gill nets from South Rush Lake, 2013. Confidence intervals include 80 percent (\pm CI-80) or 90 percent (\pm CI-90). BLB= black bullhead; BLC= black crappie; COC= common carp; NOP= northern pike; OSF= orangespotted sunfish; SPS= Spottail Shiner; ROB= rock bass; WAE= walleye; WHB= white bass; WHS= White sucker; YEP= yellow perch

| Species | Abundance | | Stock Density Indices | | | | Condition | |
|-------------------|-----------|-------|-----------------------|-------|-------|-------|-----------|-------|
| | CPUE | CI-80 | PSD | CI-90 | PSD-P | CI-90 | Wr | CI-90 |
| <i>Frame nets</i> | | | | | | | | |
| BLB | 9.2 | 2.0 | 78 | 6 | 46 | 7 | 96 | <1 |
| BLC | 4.3 | 1.1 | 96 | 4 | 40 | 10 | 115 | 1 |
| COC | 0.2 | 0.2 | 67 | 67 | 33 | 67 | 106 | 38 |
| NOP | 0.5 | 0.2 | 89 | 21 | 11 | 21 | 75 | 4 |
| ROB | 0.4 | 0.2 | 100 | 0 | 17 | 34 | 116 | 3 |
| WAE | 6.8 | 1.5 | 86 | 5 | 23 | 7 | 85 | 1 |
| WHB | 5.9 | 2.6 | 100 | 0 | 100 | 0 | 98 | <1 |
| WHS | 0.2 | 0.2 | 100 | 0 | 100 | 0 | 114 | 15 |
| YEP | 0.1 | 0.1 | 100 | --- | 100 | --- | 96 | --- |
| <i>Gill nets</i> | | | | | | | | |
| BLB | 0.8 | 0.6 | 100 | 0 | 100 | 0 | 98 | 8 |
| BLC | 0.5 | 0.5 | 67 | 67 | 67 | 67 | 111 | 18 |
| NOP | 6.5 | 0.6 | 97 | 4 | 5 | 6 | 83 | 1 |
| OSF ¹ | 0.2 | 0.2 | --- | --- | --- | --- | --- | --- |
| SPS ¹ | 0.3 | 0.5 | --- | --- | --- | --- | --- | --- |
| WAE | 14.7 | 1.6 | 86 | 6 | 15 | 6 | 89 | <1 |
| WHB | 0.5 | 0.5 | 100 | 0 | 100 | 0 | 97 | 8 |
| WHS | 1.0 | 0.9 | 100 | 0 | 100 | 0 | 107 | 10 |
| YEP | 12.3 | 3.4 | 32 | 9 | 23 | 8 | 98 | 1 |

Table 2. Historic mean catch rate (CPUE; catch/net night) of stock-length fish for various fish species captured in frame nets and experimental gill nets from South Rush Lake, 2010-2013. BLB= Black Bullhead; BLC= Black Crappie; COC= Common Carp; NOP= Northern Pike; OSF= Orangespotted Sunfish; ROB= Rock Bass; SMB= Smallmouth Bass; SPS= Spottail Shiner; WAE= Walleye; WHB= White Bass; WHS= White Sucker; YEP= Yellow Perch

| Species | CPUE | | | |
|-------------------|------|------|------|------|
| | 2010 | 2011 | 2012 | 2013 |
| <i>Frame nets</i> | | | | |
| BLB | 1.0 | --- | --- | 9.2 |
| BLC | 1.6 | --- | --- | 4.3 |
| COC | 1.3 | --- | --- | 0.2 |
| NOP | 0.3 | --- | --- | 0.5 |
| OSF ¹ | 0.3 | --- | --- | 0.0 |
| ROB | 0.2 | --- | --- | 0.4 |
| WAE | 2.6 | --- | --- | 6.8 |
| WHB | 1.7 | --- | --- | 5.9 |
| WHS | 0.6 | --- | --- | 0.2 |
| YEP | 0.1 | --- | --- | 0.1 |
| <i>Gill nets</i> | | | | |
| BLB | 0.8 | --- | --- | 0.8 |
| BLC | 0.5 | --- | --- | 0.5 |
| COC | 0.3 | --- | --- | 0.0 |
| NOP | 1.2 | --- | --- | 6.5 |
| OSF ¹ | 0.3 | --- | --- | 0.2 |
| SPS ¹ | 0.0 | --- | --- | 0.3 |
| WAE | 4.2 | --- | --- | 14.7 |
| WHB | 0.2 | --- | --- | 0.5 |
| WHS | 1.3 | --- | --- | 1.0 |
| YEP | 12.2 | --- | --- | 12.3 |

Table 3. Mean catch rate (CPUE; catch/net night) of stock-length fish, proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish, and mean relative weight (Wr) for selected species captured in experimental gill nets from South Rush Lake, 2010-2013. NOP= Northern Pike; WAE = Walleye; YEP = Yellow Perch

| Species | 2010 | 2011 | 2012 | 2013 | Objective |
|------------------|------|------|------|------|-----------|
| <i>Gill nets</i> | | | | | |
| NOP | | | | | |
| CPUE | 1 | --- | --- | 7 | ≥ 3 |
| PSD | 86 | --- | --- | 97 | 30-60 |
| PSD-P | 0 | --- | --- | 5 | 5-10 |
| Wr | 86 | --- | --- | 83 | --- |
| WAE | | | | | |
| CPUE | 4 | --- | --- | 15 | ≥ 10 |
| PSD | 56 | --- | --- | 86 | 30-60 |
| PSD-P | 16 | --- | --- | 15 | 5-10 |
| Wr | 96 | --- | --- | 89 | --- |
| YEP | | | | | |
| CPUE | 12 | --- | --- | 12 | ≥ 30 |
| PSD | 73 | --- | --- | 32 | 30-60 |
| PSD-P | 32 | --- | --- | 23 | 5-10 |
| Wr | 111 | --- | --- | 98 | --- |

Table 4. Year class distribution based on the expanded age/length summary for Walleye sampled in gill nets and associated stocking history (# stocked x 1000) from South Rush Lake, 2010-2013.

| Survey Year | Year Class | | | | | | | | | | | |
|------------------|------------|------|------|-------------------|------|------|------|------|------|------|------|------|
| | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 |
| 2013 | | 5 | 3 | 55 | 14 | 12 | 1 | | 1 | | | 1 |
| 2010 | --- | --- | --- | | 3 | 10 | 10 | 1 | 4 | | | |
| # stocked | | | | | | | | | | | | |
| fry | | 850 | | 1100 ¹ | | | | | | | | |
| small fingerling | | | | | | | | | | | | |
| large fingerling | | | | | | | | | | | | |

¹ Stocked Walleye were OTC marked; 0 of 11 otoliths collected from age-0 Walleye exhibited marks. The estimated stocking contribution was 0%, but sample size was low and the results should be interpreted with caution

Table 5. Weighted mean total length (mm) at capture for Walleye age-1 through age-8 captured in experimental gill nets (expanded sample size) from South Rush Lake, 2010-2013. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

| Year | Age | | | | | | | |
|------|--------|---------|---------|---------|---------|--------|-----|--------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 2013 | 130(5) | 302(3) | 420(55) | 492(14) | 516(12) | 633(1) | --- | 600(1) |
| 2010 | 219(3) | 349(10) | 429(10) | 472(1) | 549(4) | --- | --- | --- |

¹ Older Walleye were sampled, but are not reported in this table

Table 6. Stocking history including size and number for fishes stocked into South Rush Lake, 2002-2013. WAE= Walleye

| Year | Species | Size | Number |
|------|---------|------|-----------|
| 2010 | WAE | fry | 1,100,000 |
| 2012 | WAE | fry | 850,000 |

Table 7. Year class distribution based on expanded age/length summary for Yellow Perch sampled in gill nets from South Rush Lake, 2010-2013.

| Survey Year | Year Class | | | | | | |
|-------------|------------|------|------|------|------|------|------|
| | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 |
| 2013 | | 2 | 55 | 10 | 6 | | 3 |
| 2010 | --- | --- | --- | | 18 | 35 | 28 |

Table 8. Weighted mean total length (mm) at capture by gender for Yellow Perch captured in experimental gill nets (expanded sample size) from South Rush Lake, 2010-2013. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends.

| Year | Age | | | | | |
|----------|----------|----------|----------|---------|-----|---------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 2013 | | | | | | |
| Male | --- | 175 (5) | 230 (1) | 256 (1) | --- | 267 (1) |
| Female | 102 (2) | 178 (50) | 266 (9) | 309 (5) | --- | 354 (2) |
| Combined | 102 (2) | 178 (55) | 262 (10) | 300 (6) | --- | 325 (3) |
| 2010 | | | | | | |
| Male | 127 (6) | 185 (10) | 223 (1) | --- | --- | --- |
| Female | 127 (12) | 216 (25) | 256 (27) | --- | --- | --- |
| Combined | 127 (18) | 207 (35) | 255 (28) | --- | --- | --- |

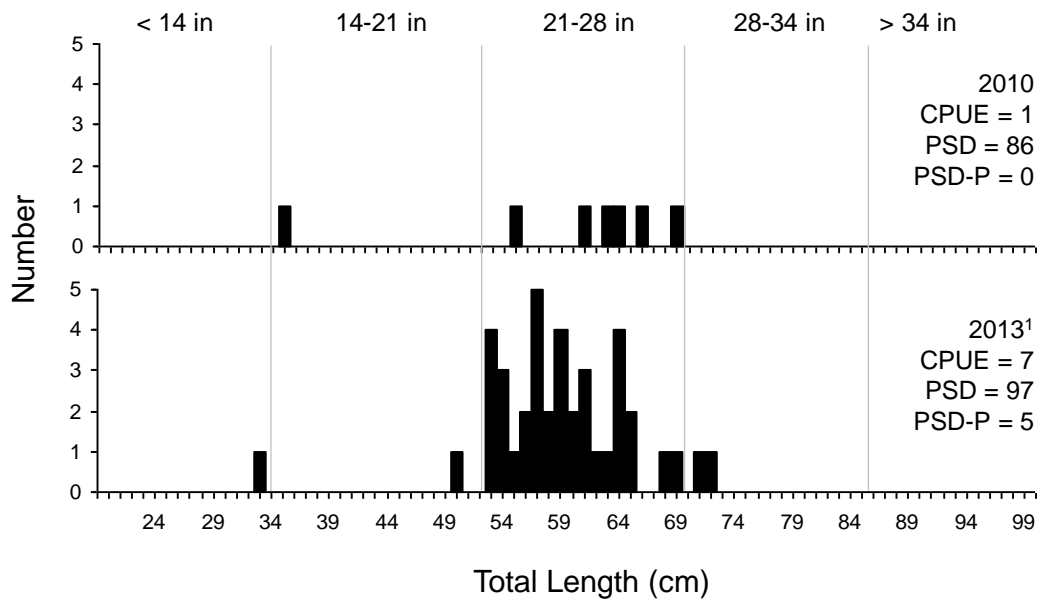


Figure 2. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Northern Pike captured using experimental gill nets in South Rush Lake, 2010-2013.

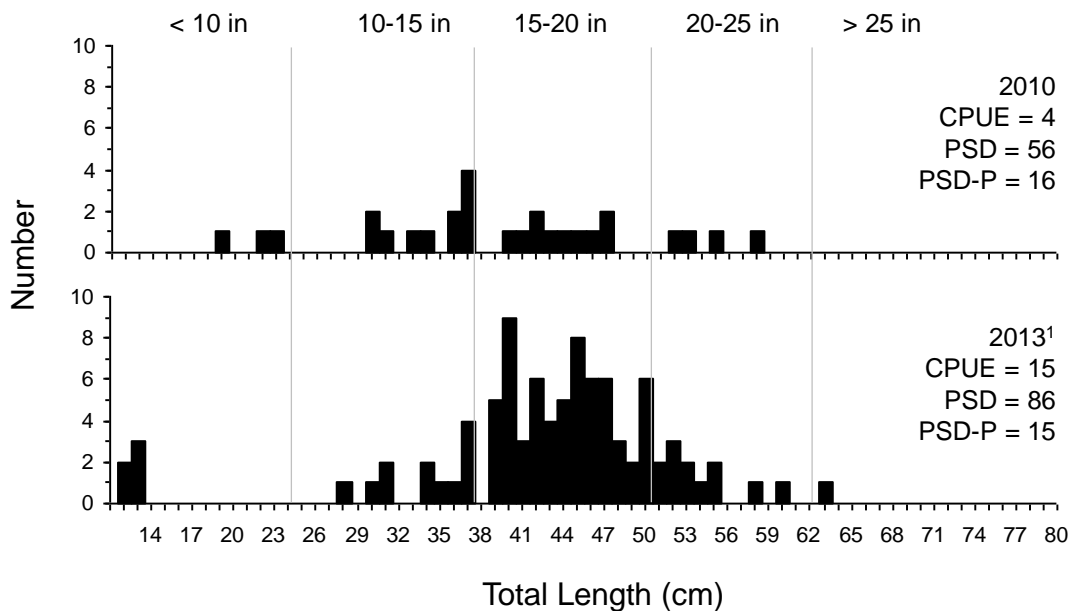


Figure 3. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Walleye captured using experimental gill nets in South Rush Lake, 2010-2013.

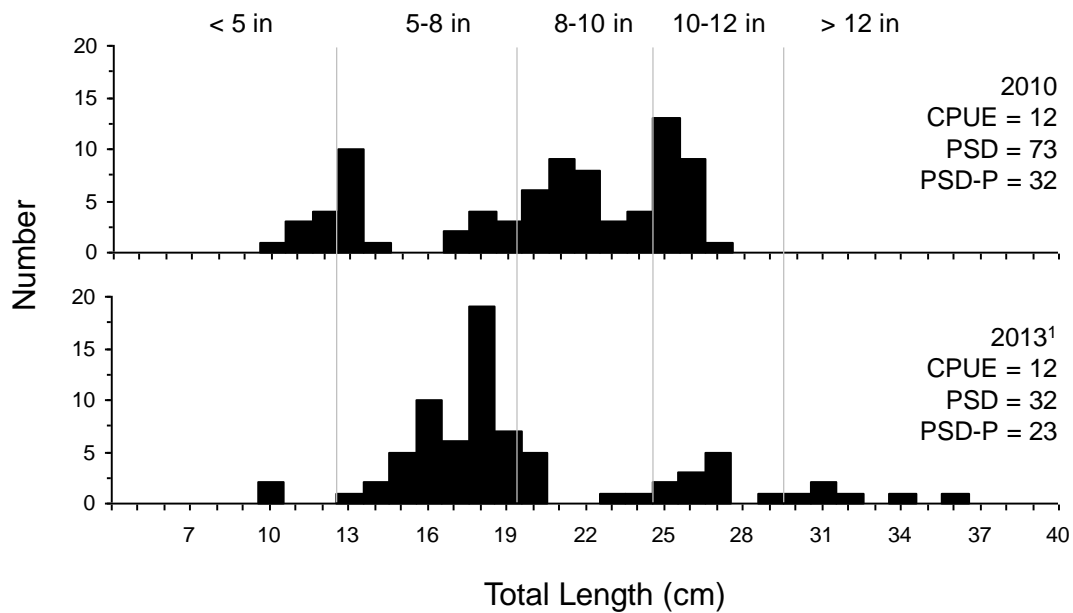


Figure 4. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Yellow Perch captured using experimental gill nets in South Rush Lake, 2010-2013.

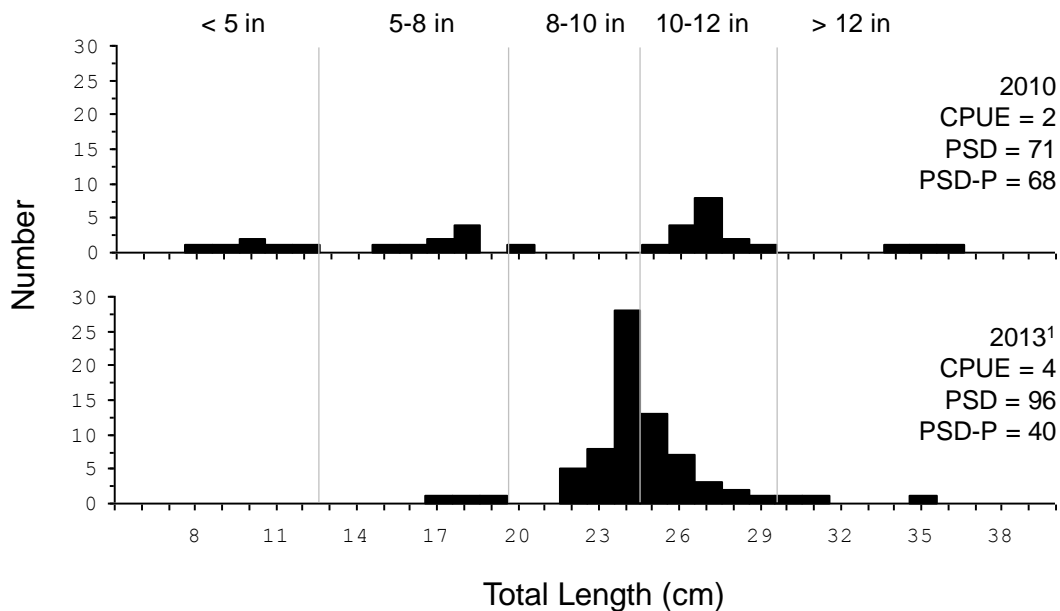


Figure 5. Length-frequency histogram, catch rate of stock-length fish (CPUE), proportional size distribution of quality- (PSD) and preferred-length (PSD-P) fish for Black Crappie captured using frame nets in South Rush Lake, 2010-2013.